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Geology of the Liquid Propane Gas Storage Facility Near Greenwood, Nebraska

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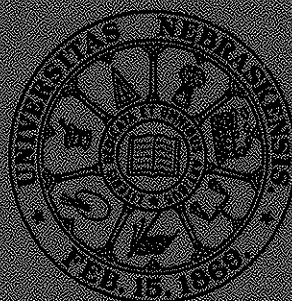
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GEOLOGY OF THE LIQUID PROPANE GAS STORAGE FACILITY NEAR GREENWOOD, NEBRASKA

Raymond R. Burchett



**NEBRASKA GEOLOGICAL SURVEY
REPORT OF INVESTIGATIONS NO. 10**

**CONSERVATION AND SURVEY DIVISION
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
UNIVERSITY OF NEBRASKA-LINCOLN**

GEOLOGY OF THE LIQUID PROPANE GAS STORAGE FACILITY NEAR GREENWOOD, NEBRASKA

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In the spring of 1962 and 1963, a series of five core tests were drilled for the Mid-America Pipeline Co. near Greenwood, Nebraska (Figure 1). These tests were drilled by Layne-Western Company to determine the feasibility of excavating an underground cavern facility for storage of liquid propane gas (LP-gas). A description of the first core test (Plate 1) and correlation logs of the other four tests are included in this report.

The five tests indicated that a cavern would be feasible in the Bonner Springs Shale and Wyandotte Limestone of Pennsylvanian age. Fenix & Scisson, Inc., of Tulsa, Oklahoma, constructed the cavern between the depths of 325 and 350 feet below land surface, in the NE 1/4 NE 1/4 section 12, township 11 north, range 8 east.

Excavation of the cavern (Figure 2) was begun in February 1963 by a process called the room-and-pillar mining method. By this process, a network of corridors 20 feet wide and 25 feet high were mined through the shale and limestone, leaving blocks or pillars approximately 50 feet square as support. Construction was completed in November 1963. The cavern provides storage for 400,000 barrels of LP-gas and services an area of 150-mile radius during periods of peak gas demands.

In this storage area, unconsolidated deposits of glacial till, sand, silt, and clay, all of Quaternary age, mantle an eroded surface of Pennsylvanian limestones and shales, which extend to a depth of about 600 feet below the land surface. Beneath the Pennsylvanian rocks are additional sedimentary rocks of Devonian, Silurian, Ordovician, and Cambrian age. Their total thickness is about 1,100 feet and they overlie the Precambrian basement complex.

The regional dip of the strata is approximately 10 to 15 feet per mile to the southwest as shown on a contour map on the base of the Kansas City Group (Figure 3). This dip is influenced by a major structural feature called the Richfield Arch located approximately 20 miles northeast of the site.

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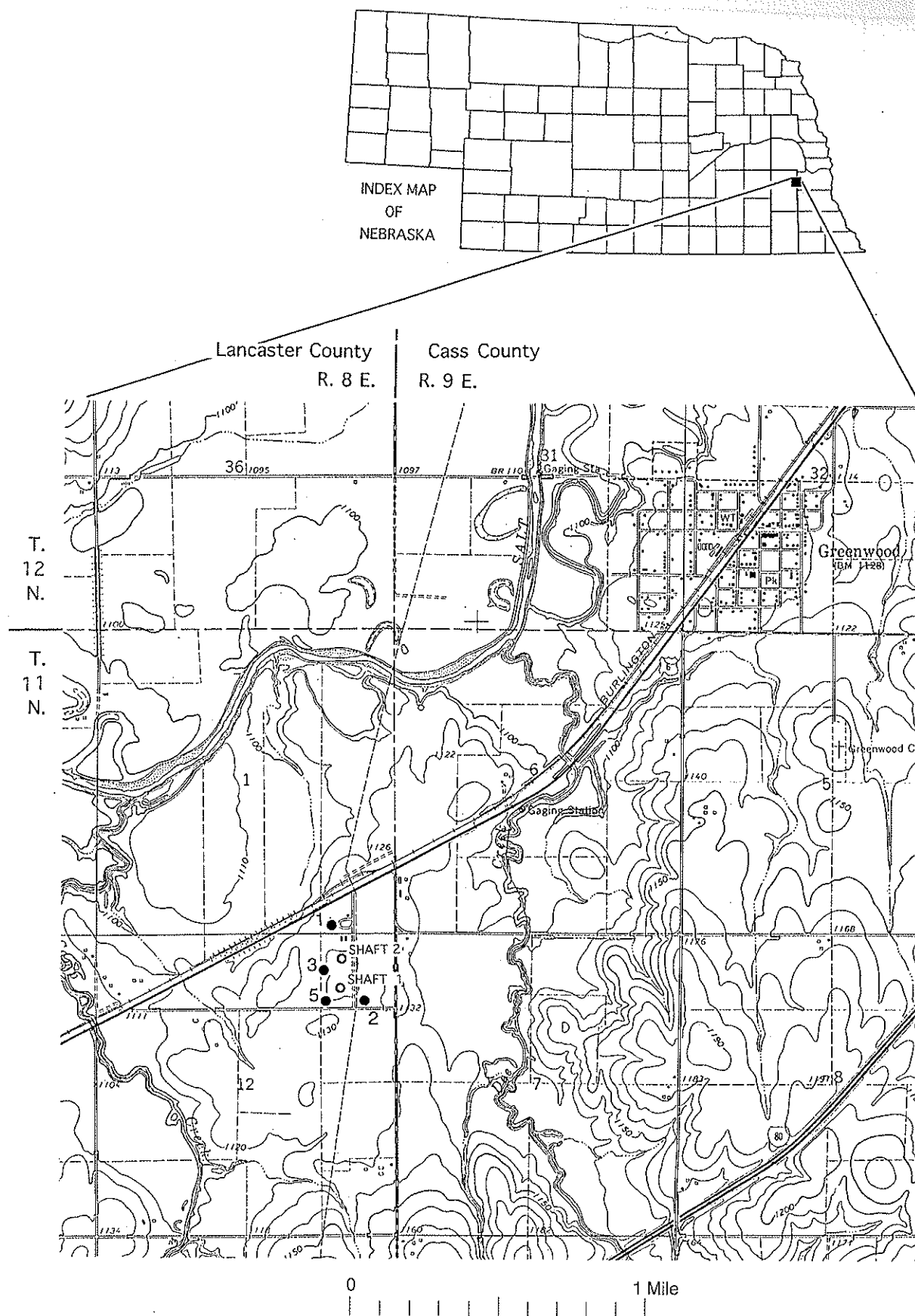


Fig. 1. Topographic map showing location of core-holes and shafts on the liquid propane gas storage facility near Greenwood, Nebraska.

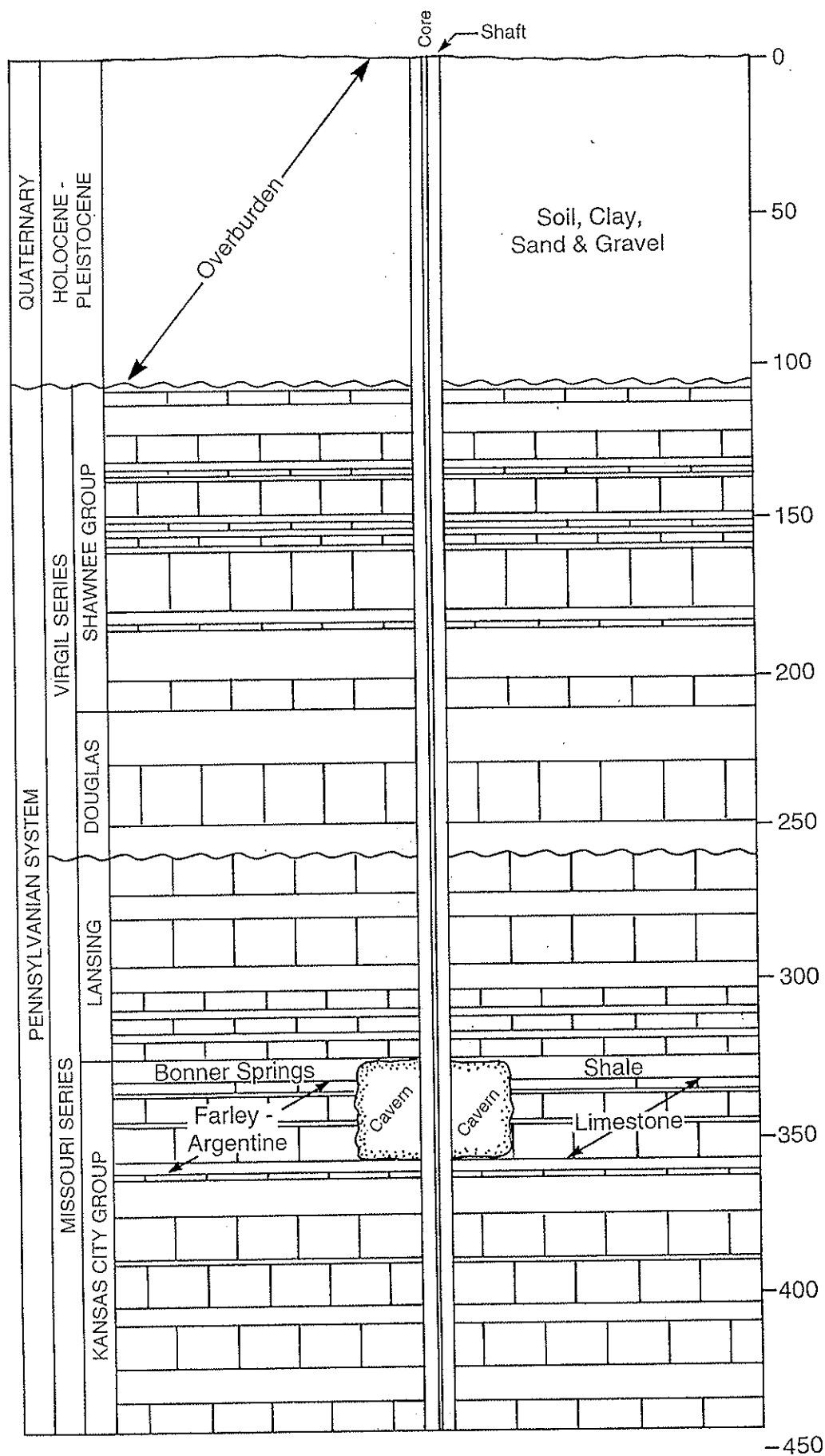


Fig. 2. Generalized cross-section of the Mid-America Pipeline Company underground liquid propane gas (LP-gas) storage facility near Greenwood, Nebraska.
(See Plate 1 for detail).

MID-AMERICA PIPELINE COMPANY CORE TEST NO. 1

Location: Lancaster County, Nebraska. SW SW SE SE, sec. 1, T.11 N., R. 8 E., approximately 110 feet north and 1,000 feet west of the southeast corner.

Ground elevation: 1,121.5 feet (Greenwood 7.5 min. quadrangle).

Surface casing set at 106.5 feet. Rotary drilling from 0 to 108.0 feet. Core drilling from 108.0 feet to total depth.

Started: March 23, 1962. Completed: April 16, 1962. Total Depth: 445.5 feet.

Correlation Log

		Depth, in feet	
		From	To
Quaternary System:			
Holocene and Pleistocene Series:			
Soil, clay, sand, and gravel	.....	0.0	106.0
Pennsylvanian System:			
Virgil Series:			
Shawnee Group:			
Tecumseh Shale	.....	106.0	113.0
Lecompton Limestone	.....	113.0	148.0
Kanwaka Shale	.....	148.0	156.5
Oread Limestone	.....	156.5	210.5
Douglas Group:			
Lawrence Shale	.....	210.5	228.6
Case Limestone	.....	228.6	248.0
Plattford Shale	.....	248.0	259.0
Missouri Series:			
Lansing Group:			
Stanton Limestone	.....	259.0	296.4
Vilas Shale	.....	296.4	300.6
Plattsburg Limestone	.....	300.6	324.0
Kansas City Group:			
Bonner Springs Shale	.....	324.0	332.0
Wyandotte Limestone	.....	332.0	361.0
Lane Shale	.....	361.0	373.7
Iola Limestone	.....	373.7	385.0
Chanute Shale	.....	385.0	390.2
Drum Limestone	.....	390.2	403.0
Quivira Shale	.....	403.0	406.0
Sarpy Limestone	.....	406.0	426.5
Fontana Shale	.....	426.5	435.0
Dennis Limestone	.....	435.0	445.5

Sample Description

	Depth, in feet	
	From	To
Soil, black	0.0	3.0
Clay, brown	3.0	9.0
Clay, light brown	9.0	23.0
Sand, fine	23.0	29.0
Clay, brown	29.0	35.0
Clay and fine sand, brownish	35.0	40.0
Clay, light gray	40.0	46.0
Clay, gray	46.0	49.0
Sand, fine	49.0	51.0
Sand and gravel, fine sand to small gravel	51.0	63.0
Sand, fine to coarse with clay streak	63.0	69.0
Sand, fine	69.0	78.0
Clay, blue and gray	78.0	80.0
Sand and gravel; contains blue clay	80.0	96.0
Clay, dark brown	96.0	100.0
Clay, blue	100.0	102.0
Sand, fine; contains blue clay	102.0	106.0
Shale, red	106.0	108.0
Limestone, shaly	108.0	112.5
Shale, red	112.5	113.0
Limestone, shaly	113.0	114.0
Shale, blue	114.0	114.5
Shale, red	114.5	122.5
Limestone, shaly	122.5	123.5
Limestone	123.5	126.0
Limestone, shaly	126.0	131.5
Shale, black	131.5	132.5
Shale, blue and black	132.5	134.5
Limestone, shaly	134.5	135.0
Limestone	135.0	136.5
Shale, black	136.5	137.5
Limestone	137.5	140.0
Limestone, shaly	140.0	148.0
Shale, blue	148.0	152.0
Limestone, shaly	152.0	154.0
Shale, blue	154.0	156.0
Limestone, shaly	156.0	159.0
Shale, blue	159.0	160.0
Limestone, shaly	160.0	170.0
Limestone	170.0	176.0
Limestone, shaly	176.0	179.0

Shale, blue	179.0	180.0
Shale, black	180.0	183.5
Limestone	183.5	185.0
Shale, blue	185.0	193.5
Shale, red	193.5	201.5
Limestone, shaly	201.5	202.5
Limestone	202.5	205.0
Limestone, shaly	205.0	211.5
Shale, red	211.5	223.5
Shale, blue	223.5	228.5
Limestone, shaly	228.5	241.0
Limestone	241.0	244.0
Limestone, shaly	244.0	246.0
Shale, black	246.0	247.0
Limestone, shaly	247.0	248.0
Shale, blue	248.0	250.5
Shale, red	250.5	258.5
Shale, red; contains streaks of limestone	258.5	259.5
Limestone, shaly	259.5	262.0
Limestone, shaly	262.0	266.5
Limestone	266.5	270.0
Limestone, shaly	270.0	271.5
Shale, blue	271.5	273.5
Limestone, shaly	273.5	278.0
Shale, red	278.0	279.0
Limestone, shaly	279.0	282.0
Limestone	282.0	289.0
Limestone, shaly	289.0	291.0
Limestone	291.0	292.0
Limestone, shaly	292.0	293.5
Shale, black	293.5	294.5
Limestone	294.5	295.0
Shale, blue	295.0	297.0
Shale, blue and black	297.0	298.5
Shale, blue and red	298.5	299.5
Limestone, shaly	299.5	301.5
Shale, blue; contains streaks of limestone	301.5	303.0
Limestone	303.0	307.5
Limestone, shaly	307.5	309.0
Shale, white	309.0	311.5
Limestone, shaly	311.5	313.0
Shale, gray, soft	313.0	313.5
Limestone, shaly	313.5	316.0
Shale, gray, soft; contains streaks of limestone	316.0	319.0
Limestone, shaly	319.0	324.0

Shale, blue	324.0	332.0
Limestone	332.0	335.0
Shale, blue	335.0	335.5
Limestone	335.5	339.0
Limestone, shaly	339.0	344.5
Shale, gray, soft	344.5	345.0
Limestone and chert	345.0	346.0
Limestone	346.0	347.0
Limestone, shaly	347.0	351.0
Shale, black	351.0	351.5
Limestone, shaly	351.5	354.0
Shale, blue	354.0	355.0
Limestone, shaly	355.0	357.0
Shale, black	357.0	359.0
Shale, blue	359.0	360.0
Limestone, shaly	360.0	361.0
Shale, blue	361.0	363.0
Limestone, shaly	363.0	365.0
Shale, blue	365.0	370.5
Shale, red	370.5	372.0
Shale, blue	372.0	373.0
Shale, red	373.0	374.0
Limestone	374.0	376.0
Limestone, shaly	376.0	380.0
Limestone	380.0	382.0
Limestone, shaly	382.0	384.0
Shale, blue	384.0	384.5
Limestone, shaly	384.5	388.0
Shale, black	388.0	389.0
Limestone, shaly	389.0	396.0
Shale, blue	396.0	396.5
Limestone, shaly	396.5	398.0
Limestone	398.0	403.0
Shale, blue	403.0	404.0
Shale, blue and black	404.0	405.5
Shale, blue; contains streak of limestone	405.5	409.0
Limestone, shaly	409.0	413.5
Shale, blue	413.5	414.0
Limestone	414.0	414.5
Limestone, shaly	414.5	418.5
Shale, blue	418.5	419.0
Limestone, shaly	419.0	423.5
Shale, black, oily	423.5	427.5
Shale, black and blue	427.5	430.0
Shale, blue	430.0	435.0

Limestone, shaly	435.0	440.5
Limestone; contains shale streaks	440.5	443.0
Shale, black	443.0	444.5
Limestone	444.5	445.5

MID-AMERICA PIPELINE COMPANY CORE TEST NO. 2

Location: Lancaster County, Nebraska. SW SE NE NE, sec. 12, T. 11 N., R. 8 E.,
 approximately 1,224 feet south and 630 feet west of the northeast corner.
 Ground elevation: 1,126.7 feet. (Greenwood 7.5 min. quadrangle).
 Surface casing set at 107.5 feet. Rotary drilling from 0 to 107.5 feet. Core drilling from 107.5
 feet to total depth.
 Started: January 26, 1963. Completed: February 5, 1963. Total depth: 426.5 feet.

Correlation Log

	Depth, in feet	
	From	To
Quaternary System:		
Holocene and Pleistocene Series:	0.0	107.5
Pennsylvanian System:		
Virgil Series:		
Shawnee Group:	107.5	205.5
Douglas Group:	205.5	258.5
Missouri Series:		
Lansing Group:	258.5	320.0
Kansas City Group:	320.0	426.5

Sample Description

	Depth, in feet	
	From	To
Top soil	0.0	2.5
Clay, brown	2.5	19.0
Sand, fine	19.0	27.0
Clay, brown	27.0	36.0
Sand, fine	36.0	48.0
Clay, gray	48.0	52.0
Sand, fine to coarse; contains clay streaks	52.0	80.0
Clay, blue and gray	80.0	88.0
Clay, dark brown	88.0	91.0
Clay, blue	91.0	102.0
Gravel, small	102.0	104.0
Clay, blue	104.0	107.5
Limestone	107.5	108.5
Shale; contains limestone streaks	108.5	110.5
Shale, red	110.5	119.5
Limestone, shaly	119.5	120.0
Limestone	120.0	123.5
Limestone, greenish, shaly	123.5	129.5

Shale, blue and black	129.5	131.5
Limestone	131.5	135.0
Limestone, shaly	135.0	142.0
Limestone; contains shale streaks	142.0	152.0
Limestone, shaly	152.0	158.0
Limestone	158.0	160.0
Limestone, shaly	160.0	162.0
Limestone	162.0	163.0
Limestone, shaly	163.0	166.0
Limestone; contains thin streaks of shale	166.0	170.0
Limestone, shaly	170.0	172.0
Limestone	172.0	173.5
Shale, blue	173.5	176.0
Shale, black	176.0	178.5
Limestone	178.5	180.0
Shale, blue	180.0	190.0
Limestone	190.0	192.5
Shale, red	192.5	197.5
Limestone, shaly	197.5	205.5
Shale, red	205.5	224.0
Shale, red and yellow	224.0	226.0
Limestone, shaly	226.0	240.0
Limestone	240.0	246.5
Shale, black and green	246.5	247.5
Limestone, shaly	247.5	248.5
Shale, green	248.5	250.0
Shale, red	250.0	258.5
Limestone	258.5	262.0
Shale, blue	262.0	264.0
Limestone	264.0	265.0
Limestone, shaly	265.0	268.5
Limestone; contains streaks of blue shale	268.5	270.0
Shale, red	270.0	274.0
Limestone, shaly	274.0	277.0
Limestone	277.0	280.0
Limestone, shaly	280.0	288.0
Shale, blue and black	288.0	290.0
Shale, black	290.0	290.5
Shale, blue	290.5	294.0
Limestone; contains trace of shale streaks	294.0	300.0
Shale, blue and red	300.0	302.5
Limestone	302.5	304.5
Limestone, shaly	304.5	305.5
Shale, blue	305.5	306.5
Shale, red	306.5	310.0

Limestone; contains shale streaks	310.0	314.0
Limestone	314.0	316.0
Limestone; contains shale streaks	316.0	320.0
Shale, blue; contains limestone streaks	320.0	330.0
Shale, blue	330.0	331.5
Limestone	331.5	350.0
Shale, blue; contains thin layers of limestone	350.0	355.5
Shale, black	355.5	356.5
Shale, blue; contains thin layers of limestone	356.5	360.0
Shale, blue	360.0	369.5
Shale, red	369.5	372.0
Limestone, shaly	372.0	374.0
Limestone; contains shale streaks	374.0	379.0
Limestone, shaly	379.0	380.0
Shale, blue	380.0	381.0
Shale, black	381.0	381.5
Limestone, shaly	381.5	384.0
Shale, blue	384.0	388.0
Shale, greenish	388.0	394.0
Limestone; contains trace of shale	394.0	399.0
Shale, blue	399.0	405.0
Limestone, shaly	405.0	409.5
Limestone; contains trace of shale	409.5	413.5
Limestone, shaly	413.5	422.0
Shale, black	422.0	423.5
Shale, blue and black	423.5	426.5

MID-AMERICA PIPELINE COMPANY CORE TEST NO. 3

Location: Lancaster County, Nebraska. SW NW NE NE, sec. 12, R. 11 N., E. 8 E.,
approximately 560 feet south and 1,263 feet west of the northeast corner.

Ground elevation: 1,124.0 feet. (Greenwood 7.5 min. Quadrangle).

Surface casing set at 110.0 feet. Rotary drilling from 0 to 275.0 feet. Core drilling from 275.0
feet to total depth.

Started: February 8, 1963. Completed: February 14, 1963. Total depth: 420.0 feet.

Correlation Log

	Depth, in feet	
	From	To
Quaternary System:		
Holocene and Pleistocene Series:	0.0	107.0
Pennsylvanian System:		
Virgil Series:		
Shawnee Group	107.0	212.0
Douglas Group:	212.0	265.0
Missouri Series:		
Lansing Group:	265.0	328.0
Kansas City Group:	328.0	420.0

Sample Description

	Depth, in feet	
	From	To
Top soil	0.0	1.0
Clay, light brown	1.0	20.0
Clay, brown	20.0	36.0
Sand, fine; contains clay streaks	36.0	47.0
Clay, gray	47.0	51.0
Sand, fine to coarse	51.0	64.0
Clay, brown	64.0	76.0
Sand, fine; contains clay streaks	76.0	81.0
Sand, coarse	81.0	95.0
Clay, dark brown	95.0	96.0
Clay, blue	96.0	100.0
Sand, fine to coarse	100.0	107.0
Shale, red	107.0	112.0
Limestone	112.0	117.0
Shale, red	117.0	126.0
Limestone	126.0	128.0
Shale, blue; contains limetone streaks	128.0	136.0
Limestone, hard	136.0	146.0

Shale, blue	146.0	151.0
Shale, blue; contains trace of limestone	151.0	160.0
Limestone; contains trace of shale	160.0	181.5
Shale, blue	181.5	186.0
Shale, black	186.0	188.0
Limestone, hard	188.0	190.0
Shale, blue	190.0	196.5
Shale, red	196.5	205.0
Limestone	205.0	212.0
Shale, blue	212.0	220.0
Shale, red	220.0	225.0
Limestone, shaly	225.0	247.0
Shale, black	247.0	249.0
Limestone, hard	249.0	254.0
Shale, blue	254.0	261.0
Shale, red	261.0	265.0
Limestone, hard	265.0	268.0
Limestone, shaly	268.0	271.0
Limestone; contains shale streaks	271.0	275.0
Limestone, shaly	275.0	277.5
Shale, red	277.5	284.0
Limestone	284.0	290.5
Limestone, shaly	290.5	297.0
Shale, blue	297.0	298.5
Shale, black	298.5	299.5
Shale, blue; contains trace of limestone	299.5	300.5
Shale, blue	300.5	303.0
Limestone, shaly	303.0	308.0
Shale, blue	308.0	309.5
Limestone	309.5	312.0
Limestone, shaly	312.0	314.0
Limestone	314.0	324.0
Limestone, shaly	324.0	328.0
Shale, blue	328.0	336.0
Limestone, shaly	336.0	338.0
Limestone; contains trace of shale streaks	338.0	348.0
Limestone	348.0	359.0
Shale, blue	359.0	368.5
Limestone, shaly	368.5	369.0
Shale, blue	369.0	375.0
Shale, red	375.0	377.0
Shale, blue	377.0	377.5
Limestone; contains trace of shale	377.5	385.0
Limestone, shaly	385.0	387.0
Limestone	387.0	388.0

Shale, blue	388.0	390.0
Shale, black	390.0	390.5
Shale, blue	390.5	397.0
Shale, red	397.0	398.0
Limestone, shaly	398.0	400.0
Shale, blue, soft	400.0	401.0
Limestone	401.0	406.0
Shale, blue	406.0	408.0
Shale, blue; contains small streaks of limestone	408.0	412.0
Limestone, shaly	412.0	420.0

MID-AMERICA PIPELINE COMPANY CORE TEST NO. 4

Location: Lancaster County, Nebraska. SW NE NE NE, sec. 12, T. 11 N., R. 8 E.,
approximately 585 feet south and 650 feet west of the northeast corner.

Ground elevation: 1,122.0 feet. (Greenwood 7.5 min. Quadrangle).

Surface casing set at 104.0 feet. Rotary drilling from 0 to 275.0 feet. Core drilling from 275.0
feet to total depth.

Started: February 18, 1963. Completed: February 26, 1963. Total depth: 422.0 feet.

Correlation Log

	Depth, in feet	
	From	To
Quaternary System:		
Holocene and Pleistocene Series:	0.0	102.0
Pennsylvanian System:		
Virgil Series:		
Shawnee Group:	102.0	208.0
Douglas Group:	208.0	255.0
Missouri Series:		
Lansing Group:	255.0	317.0
Kansas City Group:	317.0	422.0

Sample Description

	Depth, in feet	
	From	To
Soil, black	0.0	1.0
Clay, light brown	1.0	18.0
Clay, dark brown	18.0	21.0
Clay; contains coarse sand	21.0	30.0
Clay, brown, sandy	30.0	42.0
Sand, fine to coarse	42.0	48.0
Clay, gray	48.0	52.0
Sand, fine to coarse	52.0	74.0
Clay, gray	74.0	80.0
Sand, fine to coarse	80.0	94.0
Clay, blue	94.0	96.0
Sand, fine to coarse	96.0	102.0
Limestone, hard	102.0	106.0
Shale, gray	106.0	108.0
Shale, red	108.0	118.0
Limestone	118.0	123.0
Shale, blue	123.0	127.0
Limestone	127.0	135.0

Limestone, shaly	135.0	144.0
Shale, blue	144.0	149.0
Limestone, shaly	149.0	151.5
Shale, blue	151.5	154.0
Limestone	154.0	156.0
Shale, blue	156.0	157.0
Limestone, shaly	157.0	159.0
Limestone, hard	159.0	162.0
Limestone, shaly	162.0	169.0
Shale, blue	169.0	173.0
Shale, black	173.0	176.0
Limestone	176.0	179.0
Shale, blue; contains thin streak of limestone	179.0	190.0
Shale, red	190.0	195.0
Limestone, shaly	195.0	206.0
Limestone; contains shale streaks	206.0	208.0
Shale, red	208.0	221.0
Limestone, shaly	221.0	239.0
Shale, black	239.0	240.0
Shale, blue	240.0	246.0
Shale, red	246.0	255.0
Limestone, shaly	255.0	259.0
Limestone; contains shale streaks	259.0	263.0
Shale, blue	263.0	265.0
Limestone, hard	265.0	267.0
Shale, blue	267.0	268.0
Shale, red	268.0	273.0
Limestone, shaly	273.0	275.0
Limestone	275.0	280.0
Limestone, shaly	280.0	286.5
Shale, black	286.5	287.5
Limestone	287.5	288.0
Shale, blue	288.0	291.0
Limestone	291.0	296.0
Shale, blue	296.0	297.0
Limestone	297.0	301.5
Shale, blue	301.5	303.0
Limestone	303.0	311.0
Limestone, shaly	311.0	314.0
Limestone; contains shale streaks	314.0	315.0
Shale, blue	315.0	326.0
Shale, red	326.0	327.0
Limestone	327.0	328.0
Limestone, shaly	328.0	331.0
Limestone, shaly	331.0	341.5

Limestone	341.5	343.0
Limestone, shaly	343.0	350.0
Shale, blue	350.0	364.0
Shale, red	364.0	366.0
Limestone	366.0	367.0
Limestone, shaly	367.0	371.0
Limestone	371.0	373.5
Limestone, shaly	373.5	375.0
Limestone	375.0	376.0
Shale, blue	376.0	382.0
Shale, black; contains limestone	383.0	383.0
Limestone, shaly	383.0	387.0
Limestone	387.0	392.5
Shale, blue	392.5	397.0
Limestone, shaly	397.0	398.0
Shale, black	398.0	398.5
Limestone, shaly	398.5	407.0
Limestone	407.0	412.0
Limestone, shaly	412.0	414.0
Shale, blue	414.0	415.0
Shale, black	415.0	417.5
Shale, blue	417.5	422.0

MID-AMERICA PIPELINE COMPANY CORE TEST NO. 5

Location: Lancaster County, Nebraska. SW SW NE NE, sec. 12, T. 11 N., R. 8 E.,
 approximately 1,210 feet south and 1,210 feet west of the northeast corner.
 Ground elevation: 1,125.0 feet. (Greenwood 7.5 min. quadrangle).
 Surface casing set at 109.0 feet. Rotary drilling from 9 to 275.0 feet. Core drilling from 275.0
 feet to total depth.
 Started: March 1, 1963. Completed: March 12, 1963. Total depth: 421.0 feet.

Correlation Log

	Depth, in feet	
	From	To
Quaternary System:		
Holocene and Pleistocene Series:	0.0	109.0
Pennsylvanian System:		
Virgil Series		
Shawnee Group:	109.0	213.0
Douglas Group:	213.0	264.0
Missouri Series:		
Lansing Group:	264.0	330.0
Kansas City Group:	330.0	421.0

Sample Description

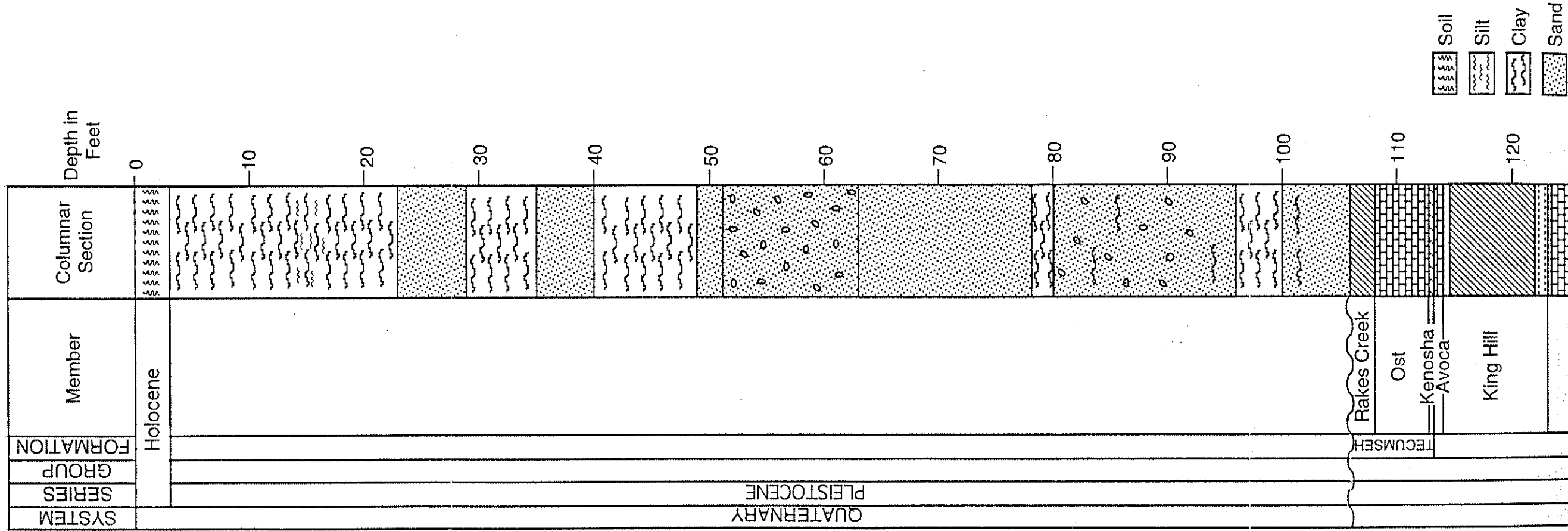
	Depth, in feet	
	From	To
Top soil	0.0	1.5
Clay, brown	1.5	24.0
Sand, fine	24.0	26.0
Clay, silty, brown	26.0	36.0
Clay, silty, brown; contains fine sand	36.0	51.0
Clay, gray	51.0	54.0
Sand, fine to coarse	54.0	79.0
Clay, brown	79.0	81.0
Sand, coarse; contains clay streaks	81.0	94.0
Clay, blue	94.0	99.0
Sand, fine; contains blue clay	99.0	104.0
Sand, coarse; contains small gravel	104.0	109.0
Limestone, shale	109.0	114.0
Shale, red	114.0	125.0
Limestone, shaly	125.0	128.0
Limestone	128.0	132.0
Shale, blue	132.0	136.0
Shale, black	136.0	137.0

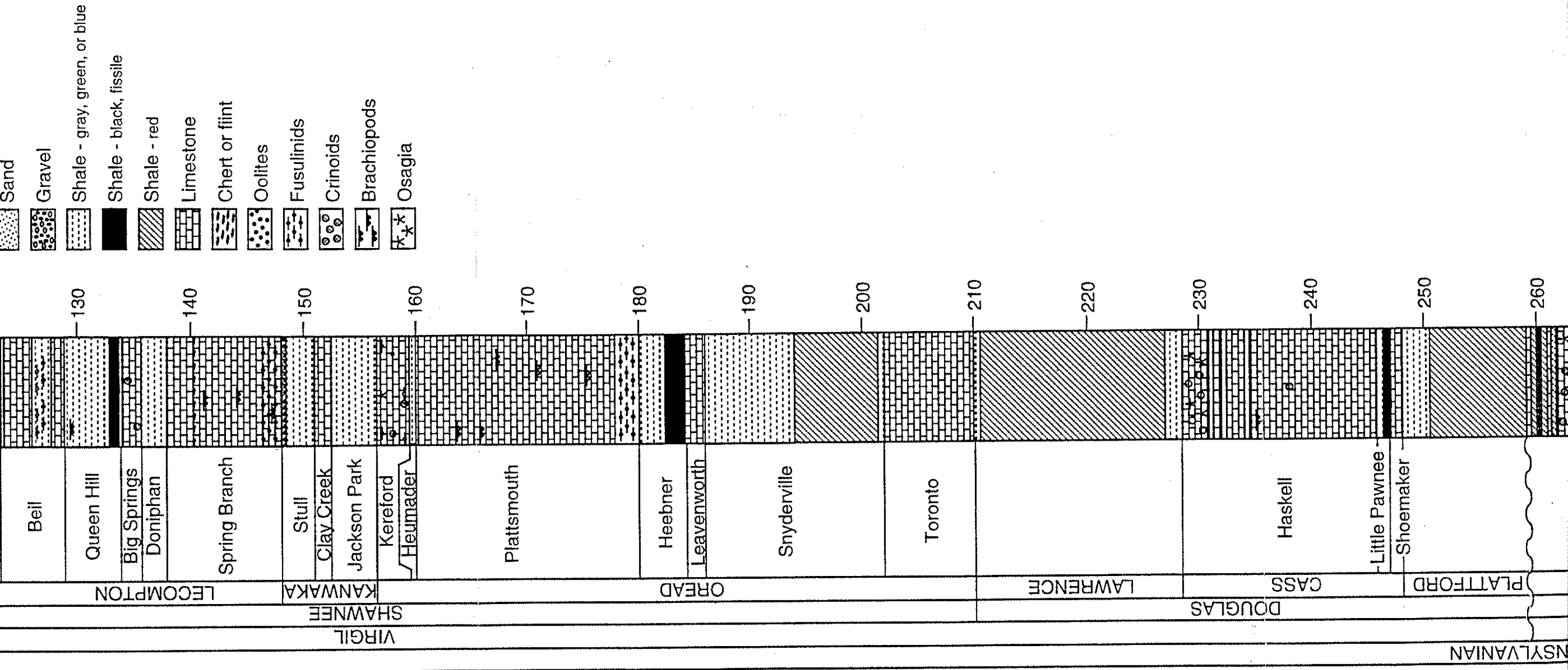
Limestone	137.0	139.0
Limestone; contains shale streaks	139.0	146.0
Shale, red	146.0	150.0
Shale, blue	150.0	156.0
Shale, blue and red	156.0	161.0
Limestone	161.0	171.0
Shale, blue	171.0	172.0
Limestone	172.0	177.0
Shale, blue	177.0	182.0
Shale, black	182.0	184.0
Limestone	184.0	187.0
Shale, blue	187.0	197.0
Shale, red	197.0	205.0
Limestone	205.0	209.0
Limestone, shaly	209.0	213.0
Shale, red	213.0	229.0
Limestone	229.0	232.0
Shale, blue	232.0	233.0
Limestone	233.0	247.0
Shale, blue	247.0	248.0
Shale, black	248.0	249.0
Shale, blue	249.0	256.0
Shale, red	256.0	264.0
Limestone	264.0	268.0
Limestone, shaly	268.0	274.0
Shale, red	274.0	278.5
Shale, blue	278.5	279.5
Limestone	279.5	289.0
Limestone, shaly	289.0	295.5
Shale, blue	295.5	296.5
Shale, black	296.5	297.0
Limestone	297.0	298.0
Shale, blue	298.0	301.0
Limestone, shaly	301.0	304.0
Shale, blue; contains trace of limestone	304.0	306.0
Limestone	306.0	309.0
Shale, blue	309.0	314.0
Limestone; contains some very hard streaks	314.0	321.5
Limestone; contains shale streaks	321.5	330.0
Shale, blue	330.0	336.5
Shale, red	336.5	338.0
limestone	338.0	345.0
Limestone; contains trace of shale	345.0	355.0
Limestone, blue, shaly	355.0	359.0
Shale, black	359.0	360.5

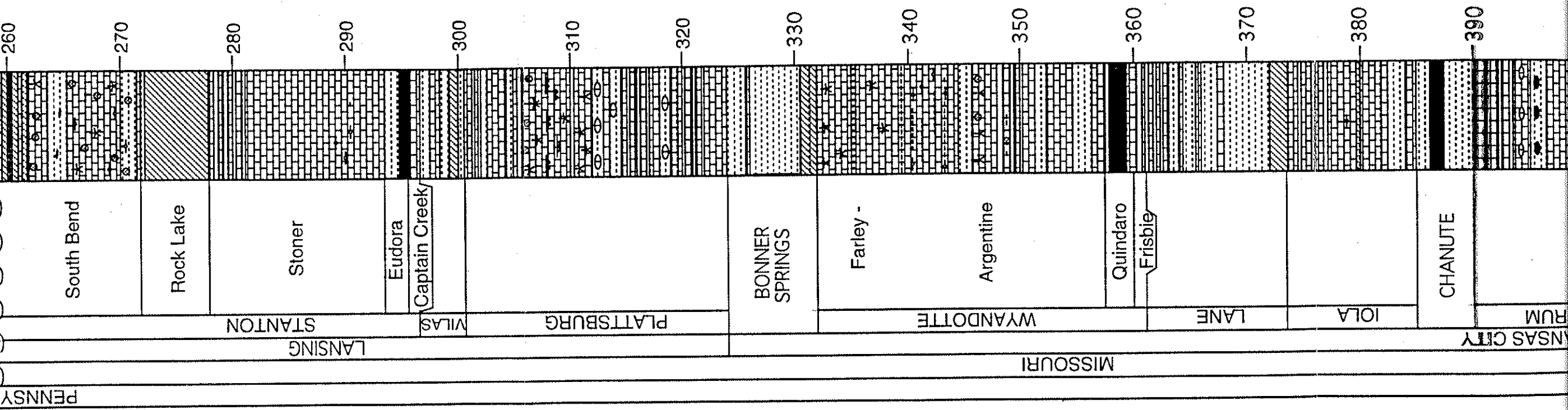
Limestone, shaly	360.5	362.0
Shale, blue	362.0	377.5
Shale, red	377.5	379.0
Limestone	379.0	386.0
Limestone, shaly	386.0	388.0
Shale, blue	388.0	390.0
Shale, blue; contains trace of limestone	390.0	394.5
Limestone	394.5	405.5
Shale, blue; contains trace of limestone	405.5	412.5
Limestone	412.5	415.5
Limestone, shaly	415.5	420.0
Limestone	420.0	421.0

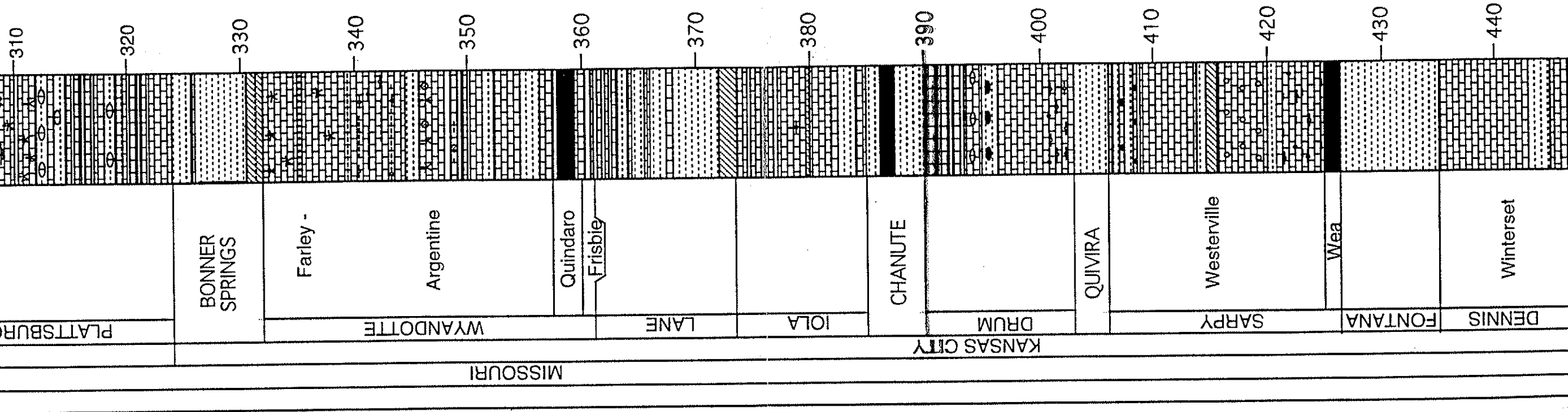
MID- AMERICA PIPELINE COMPANY CORE TEST NO. 1

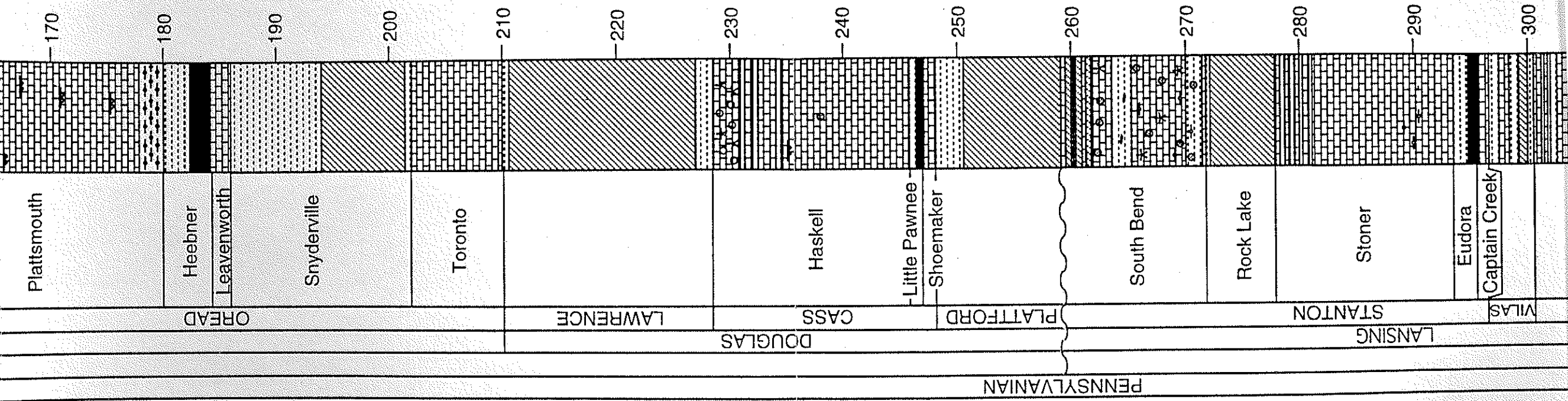
Location: Lancaster County, Nebraska. SW SW SE SE, Sec. 1, T. 11 N., R. 8 E., approximately 110 feet north and 1,000 feet west of the southeast corner.
Ground elevation: 1,121.5 feet (Greenwood 7.5 min. quadrangle).
Surface casing: set at 106.5 feet.
Rotary drilling: 0 to 108.0 feet. **Core drilling:** 108.0 feet to total depth.
Started: March 23, 1962. **Completed:** April 16, 1962. **Total Depth:** 445.5 feet.

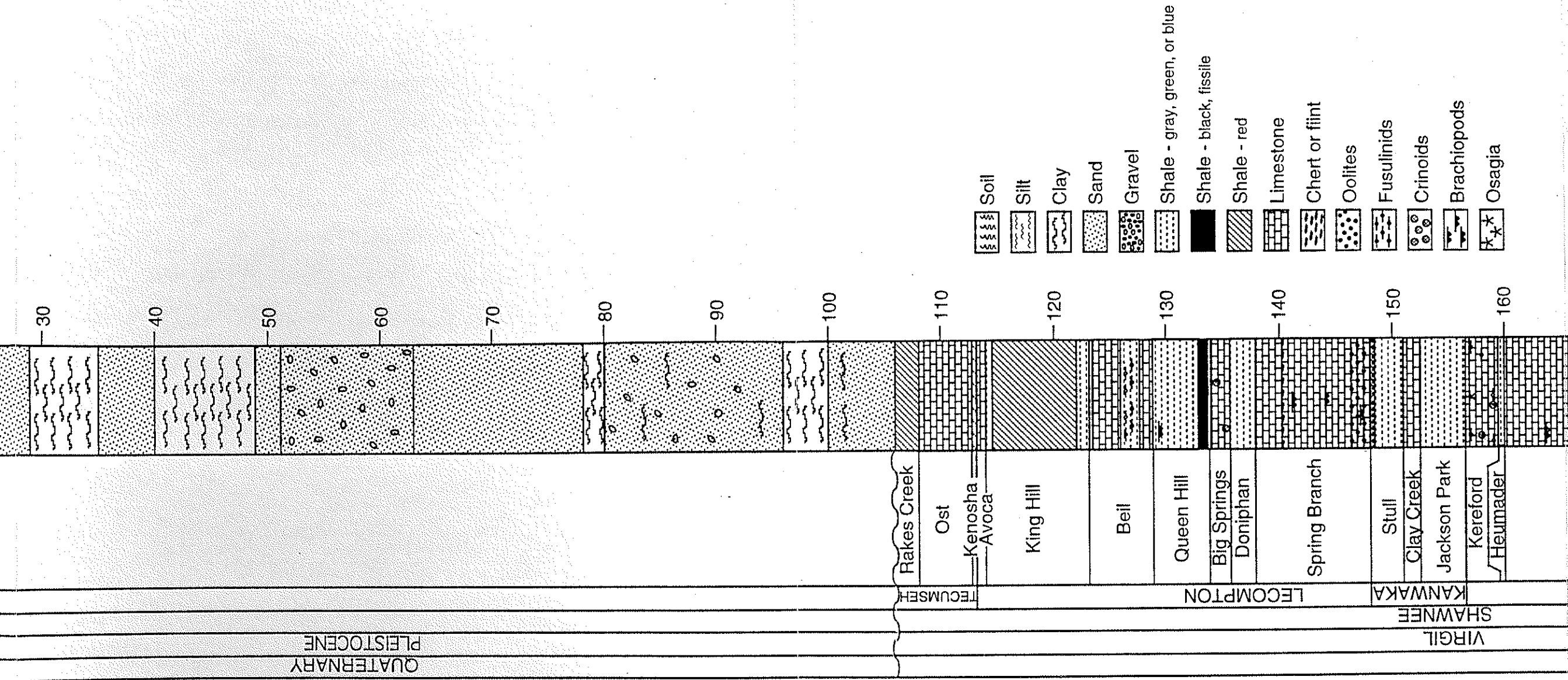












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